FUTURE COMBAT SYSTEMS
FCS
One Team-The Army/Defense/Industry

Non-Line-of-Sight Launch System

Program Update

19 April 2005

Rod Summers
Director
NLOS-LS Task Force
256-313-1049
rod.summers@msl.army.mil

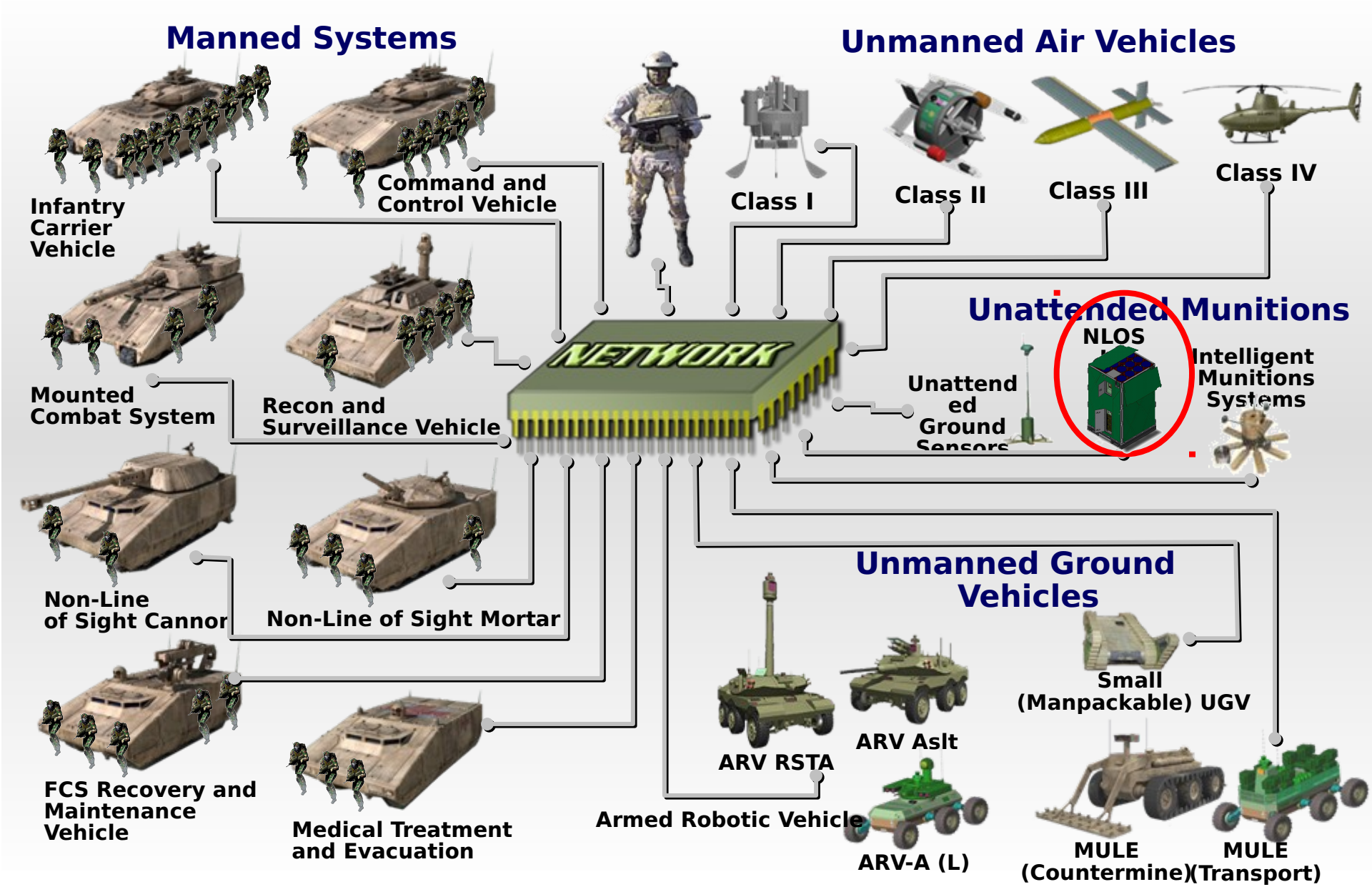
ANY SOLDIER - ANYWHERE - ALL THE T

Briefing Summary

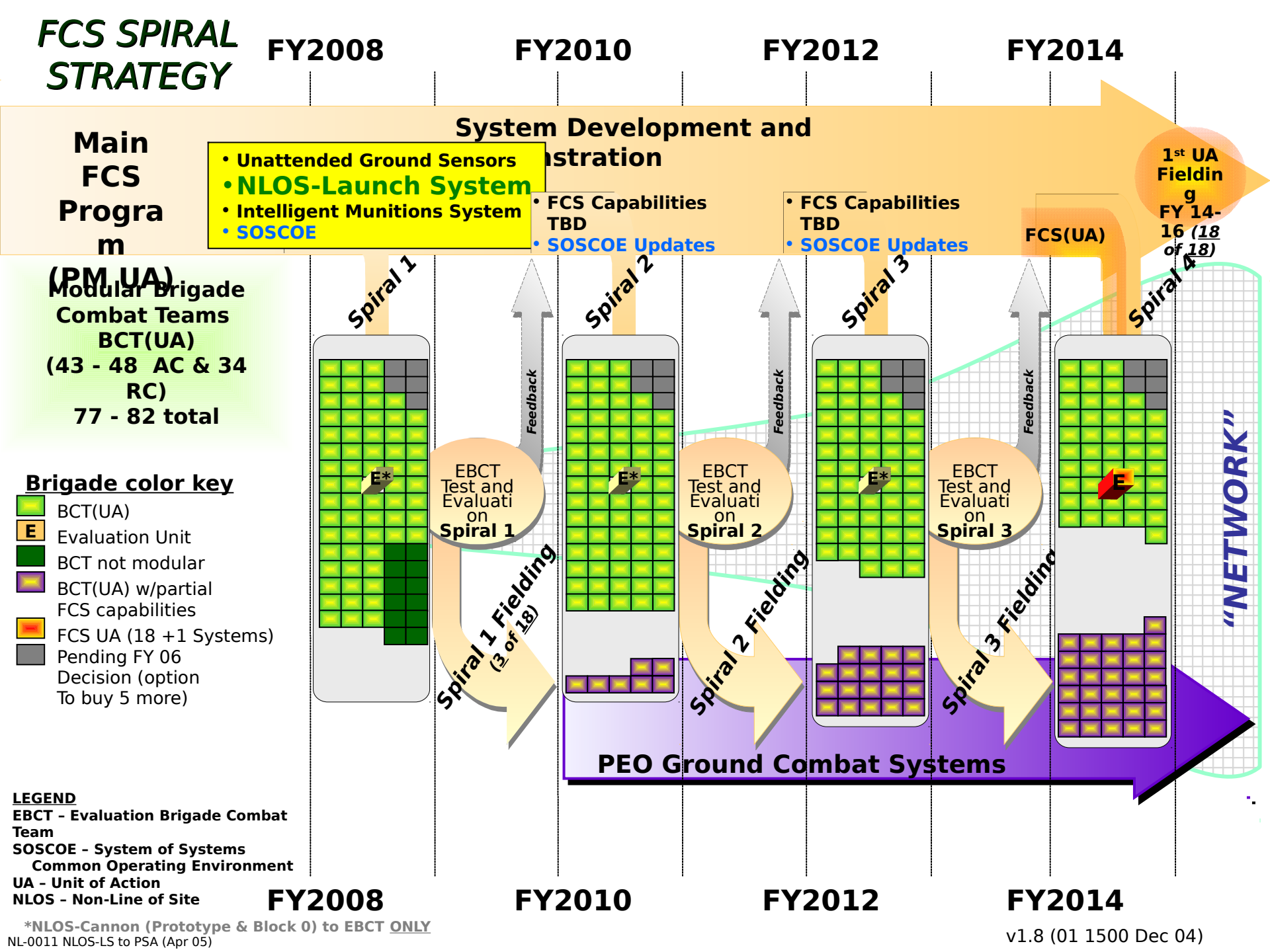
- *Overview Information*
- *Program Restructure*
- *Selected Program Accomplishments*
  - **PAM**
  - **LAM**
  - **CLU**
  - **Networking and Communications**
- *Supportability Concept*
- *S&T Strategy*
- *Take-Aways*

BLUF: NLOS-LS Program On Track Supporting FCS Spiral 1

FCS System-of-Systems



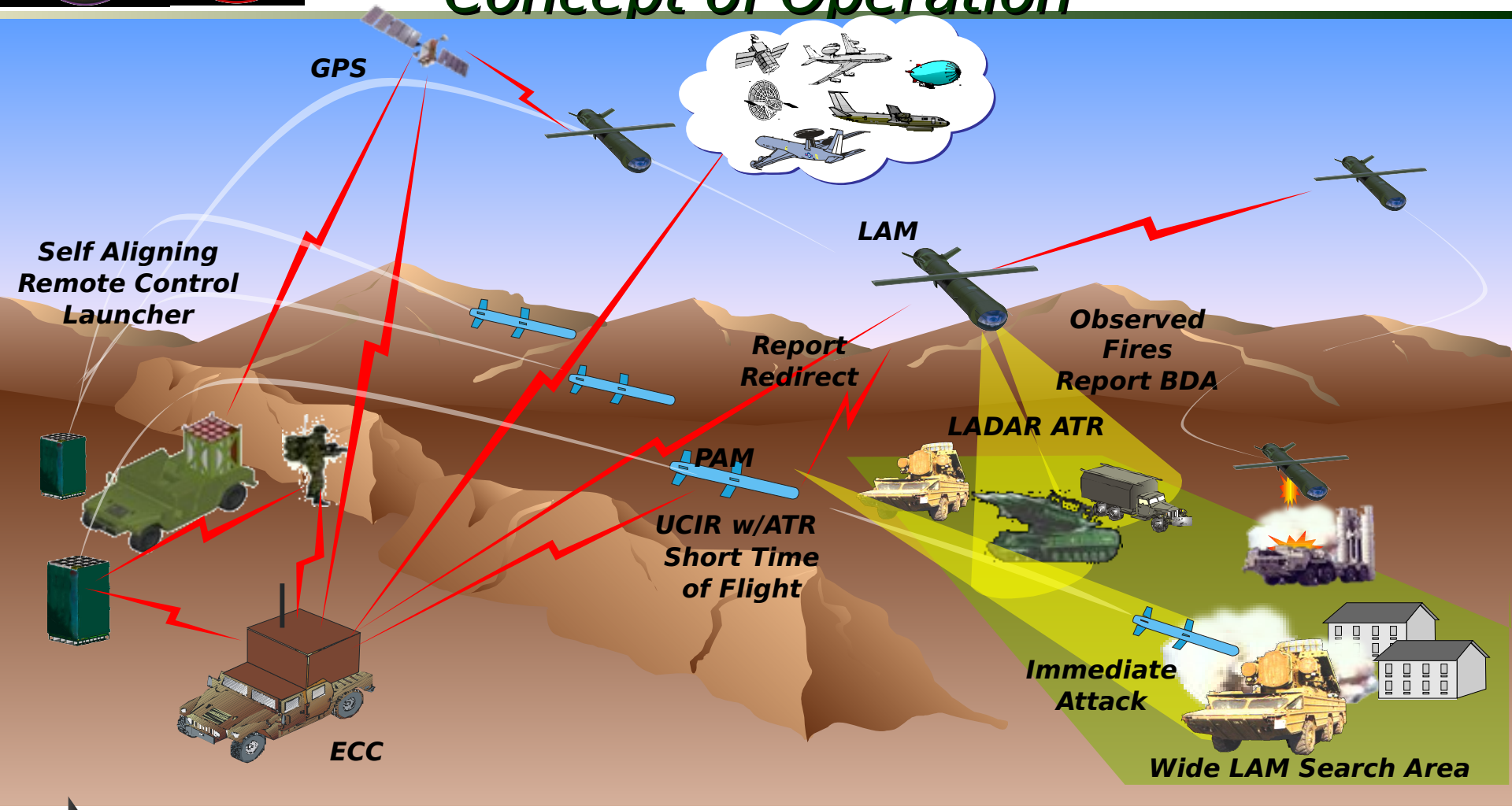
FCS SPIRAL STRATEGY



*NLOS-Cannon (Prototype & Block 0) to EBCT ONLY

NLOS-LS
Concept of Operation

FUTURE COMBAT SYSTEMS
FCS
One Team-The Army/Defense/Industry



- ***Provide Responsive, Networked, Extended-Range Targeting and Precision Attack of Armored, Lightly Armored and Other Stationary and Moving Targets During Day/Night and Near All-Weather Conditions***
- ***Be Highly Deployable and Platform Independent***

Why is NLOS-LS in Spiral 1?

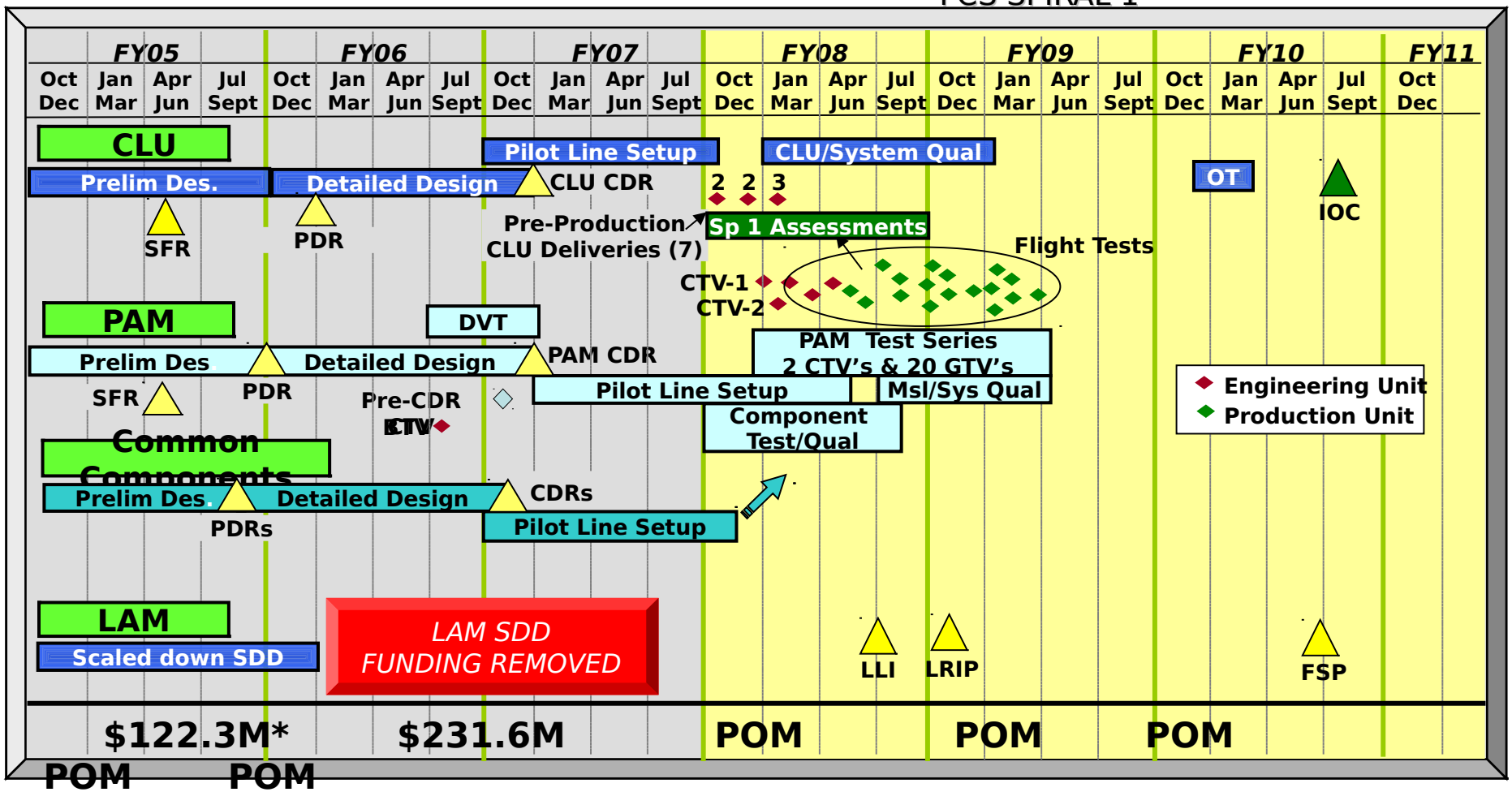
FUTURE COMBAT SYSTEMS FCS
One Team-The Army/Defense/Industry

- *Fills Capability Gaps in Brigade Combat Team Forces*
  - ***Has ability to overcome large TLEs, precisely kill hard and soft targets that are moving or stationary by target designation or autonomous means from stand-off ranges***
- *Operational Flexibility*
  - ***Offers joint forces tremendous flexibility across a spectrum of conflicts with efficient logistics, ease of transportability, and greatly reduced collateral damage***
- *Maturity of the System*
  - ***Program has been under contract since 1998 and had numerous successes***
- *Building Block for the UA*
  - ***Gives current forces a major piece of the FCS lethality capability now***

NLOS-LS Brings the Future to Today's Joint Forces

NLOS-LS Draft Restructured Program Plan

FUTURE COMBAT SYSTEMS FCS One Team-The Army/Defense/Industry



* *ASSUMES FY05 REPROGRAMMING REQUEST APPROVED*

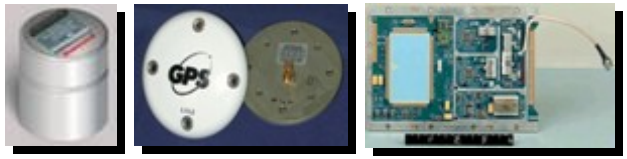
Spiral 1 Proc Qtys ▸ 6 12 30

NLOS-LS PROCUREMENT PART OF UA

Precision Attack Missile (PAM) Technical Requirements

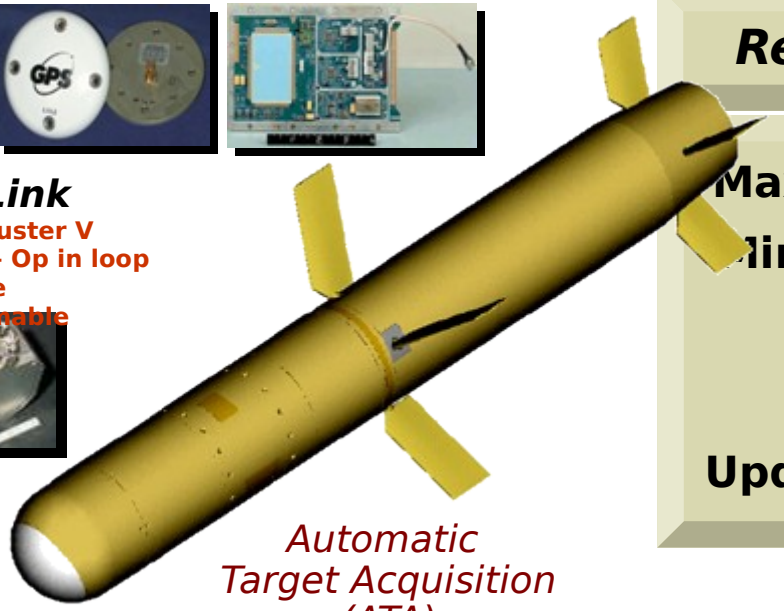
FUTURE COMBAT SYSTEMS FCS
One Team-The Army/Defense/Industry

GPS/INS Navigation System



Data Link

- JTRS Cluster V
- 2-Way – Op in loop
- Software Programmable

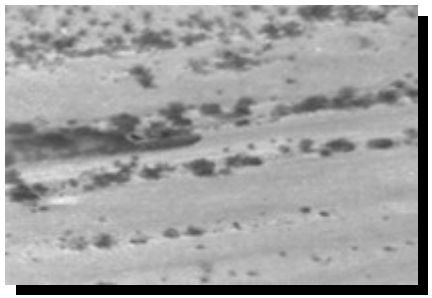


Automatic Target Acquisition (ATA)

Multi-Mode Seeker

- Semi-Active Laser (SAL)
- Un-Cooled Imaging Infra Red (UCIIR)

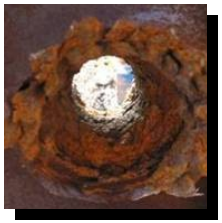
Requirement	ORD Threshold
Maximum Range	40 km
Minimum Range	500m
Target Set	High Value Targets (Armor)
Updates in Flight	Two-Way Comms w/ FCS Network



PAM Provides A 40km Precision Kill Capability Against Hard and Soft Targets Using Laser Guidance or Automatic Target Acquisition

PAM Accomplishments

Warhead Bunker Test



Armor Entrance Hole

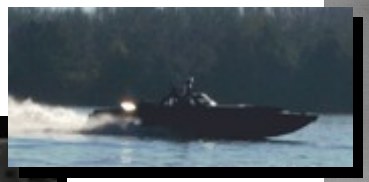
Armor Exit Hole

Warhead Armor Test

Pre IM Frag Test

Post IM Frag Test

End to End Flight Test Successes



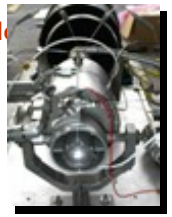
IR Seeker Images from Captive Flight Tests Against Land/Sea Targets

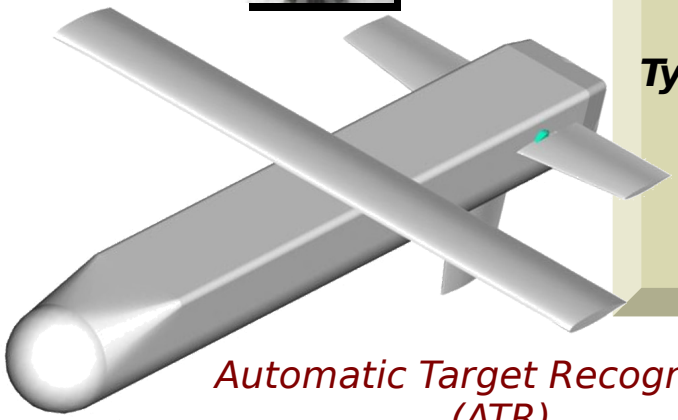
Loiter Attack Missile (LAM) Technical Requirements

FUTURE COMBAT SYSTEMS FCS One Team-The Army/Defense/Industry

Data Link
- JTRS Cluster V
- 2-Way– Op in loop
- Software Programmabl

Jet Engine
- Low Cost Turbojet

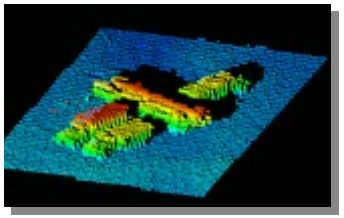




LADAR Seeker

Requirement	ORD Threshold
Maximum Range (INF Treaty)	< 480 km
Minimum Range	500m
Typical Range with Loiter (km)	70km w/ 30 min loiter
Target Set	High Value Targets (TEL/MRL)
Updates in Flight	Two-Way Comms w/ FCS Network

Automatic Target Recognition (ATR)



LAM Provides A Dedicated, Loitering Long Range Recon and Discriminating Point Kill Capability

LAM Accomplishments

FUTURE COMBAT SYSTEMS FCS
One Team-The Army/Defense/Industry

Square Body Wind Tunnel Test

Hot Engine Wind Tunnel Test

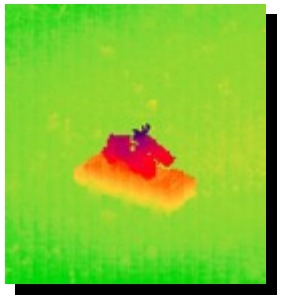
Engine Static Tests

Carbon Fiber Wing

Seeker Section

Prototype Processor Board

Captive Flight Test



LADAR ATR

Loitering Attack Missile (LAM)

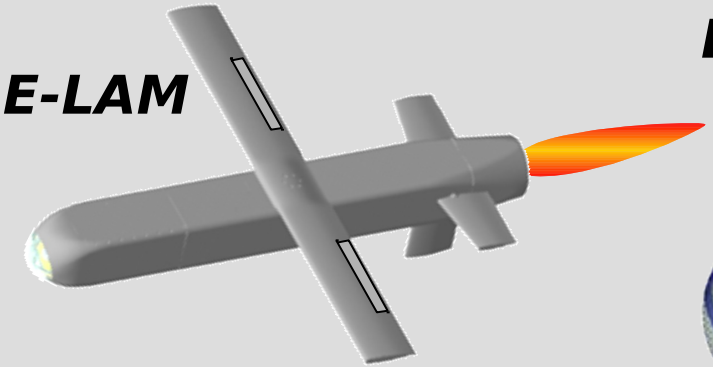
FUTURE COMBAT SYSTEMS FCS
One Team-The Army/Defense/Industry

What is the Status of LAM?

LAM Funding Removed from SDD Beginning in FY05 Due to Army Affordability Issues and Effort Shifted to Army S&T; Operational Requirement Still Valid

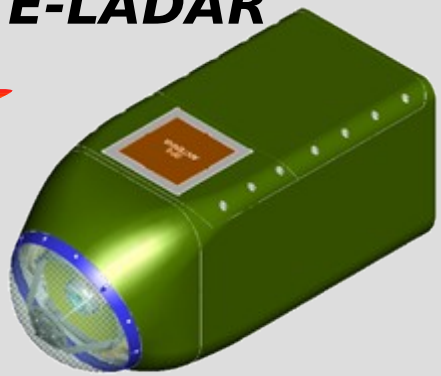
What is the Focus of LAM S&T Efforts?

E-LAM



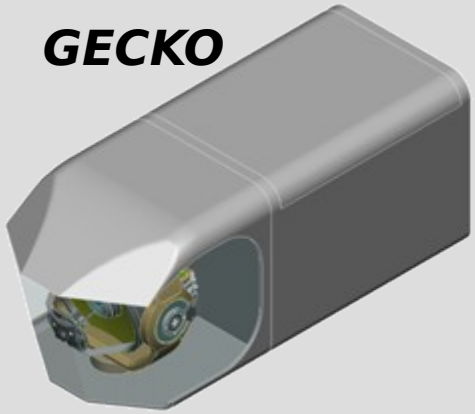
- Higher Maneuverability
- Efficient Searches
- Fly Through Stalls

E-LADAR



- More Beams and Resolution for Greater Coverage
- Lower Cost, Higher Performance Laser by Shift of Components

GECKO



- Continuous View of Targets
- Wide Field of Regard Cueing

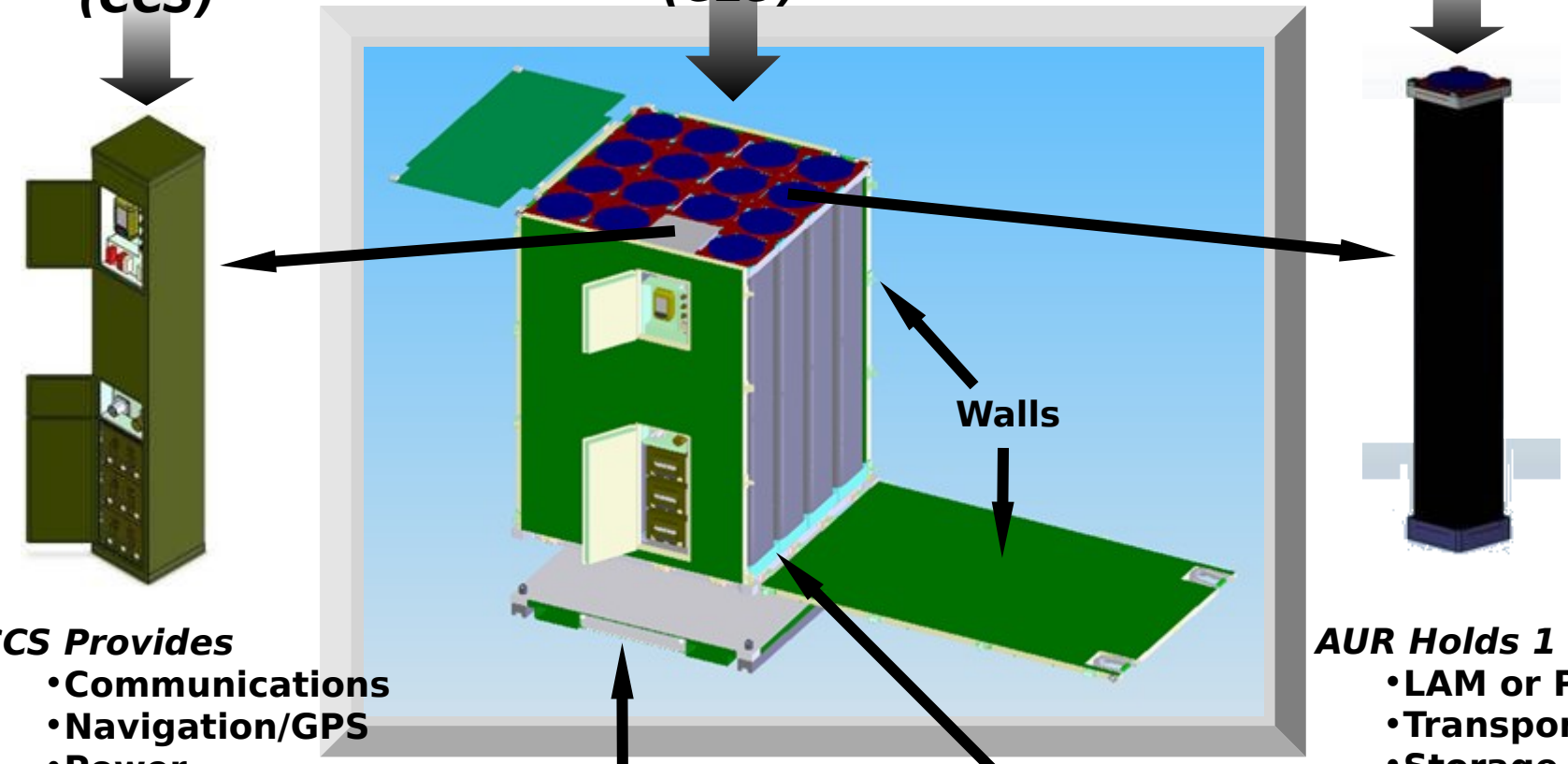
SDD CLU Baseline Concept

FUTURE COMBAT SYSTEMS FCS
One Team-The Army/Defense/Industry

Computer and Communications System (CCS)

Container Launch Unit (CLU)

All Up Round (AUR



CCS Provides
- Communications
- Navigation/GPS
- Power
- Man Interface
- I/O to AURs in Base

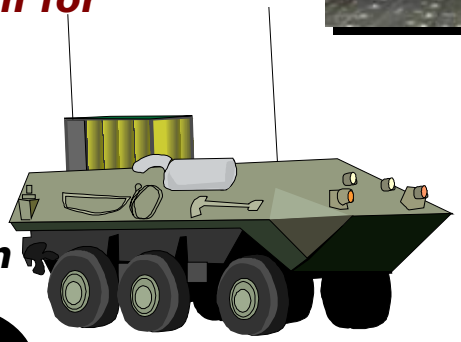
AUR Holds 1 Missi
- LAM or PAM
- Transportatio
- Storage
- Launch
- I/O in base to

NLOS-LS
Platform Independence

FUTURE COMBAT SYSTEMS
FCS
One Team-The Army/Defense/Industry

HIMARS Resupply Vehicle Chosen as NLOS-LS Platform for

Roll Off: Immediate Mission



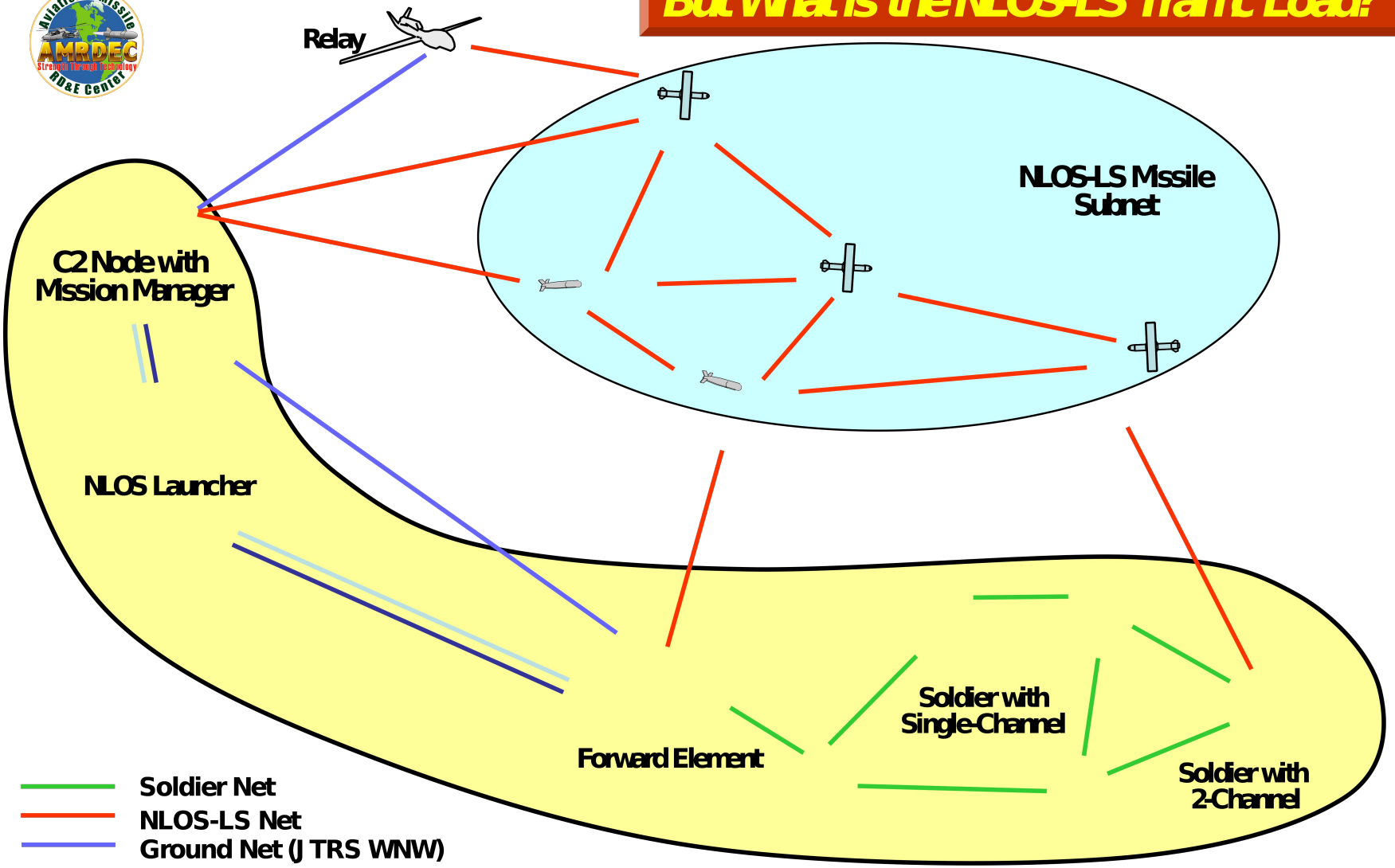
Roll Off: Have 30 minutes prep time before mission

Helo Transport

NLOS-LS
Comms Architecture

FUTURE COMBAT SYSTEMS
FCS
One Team-The Army/Defense/Industry

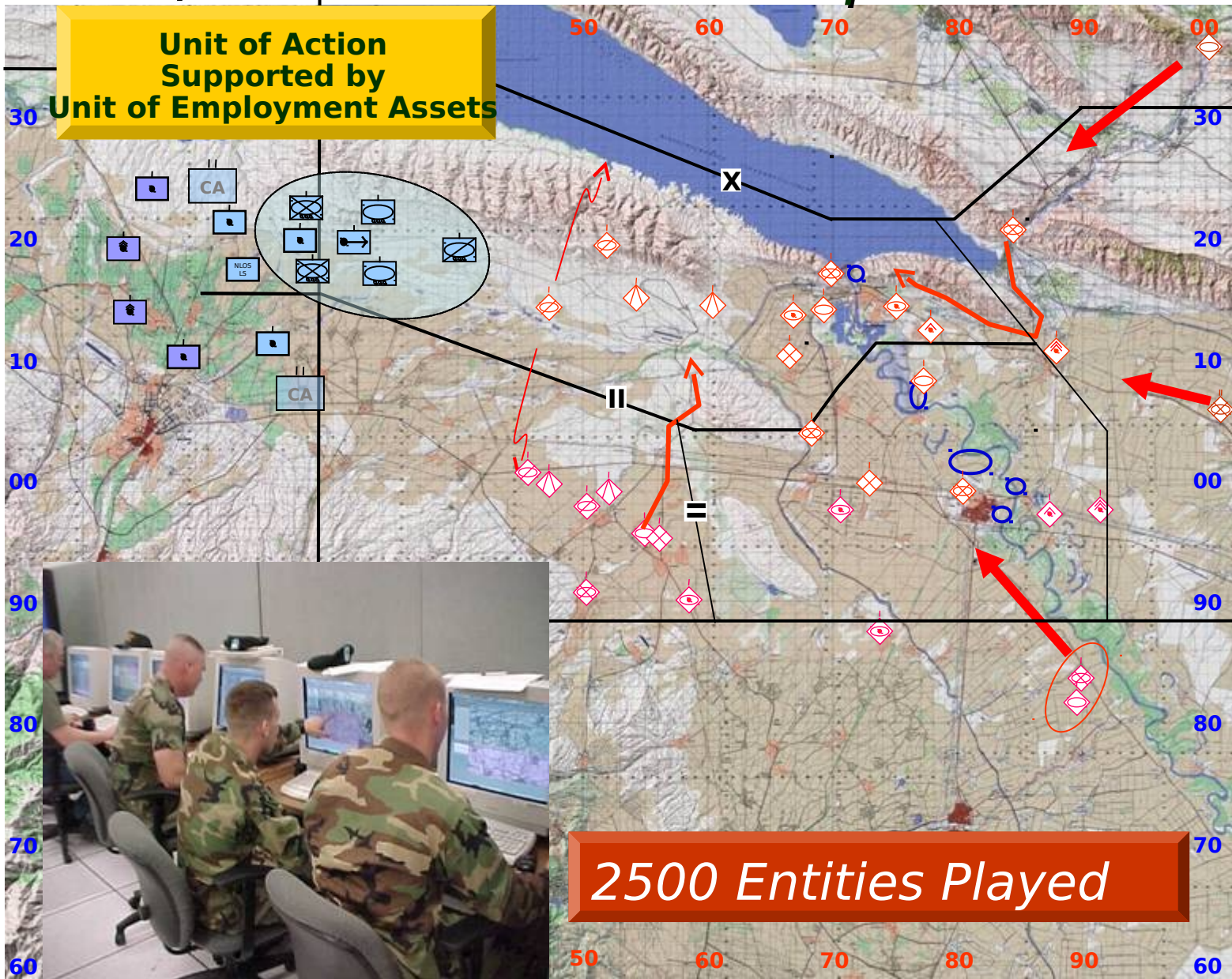
But What is the NLOS-LS Traffic Load?



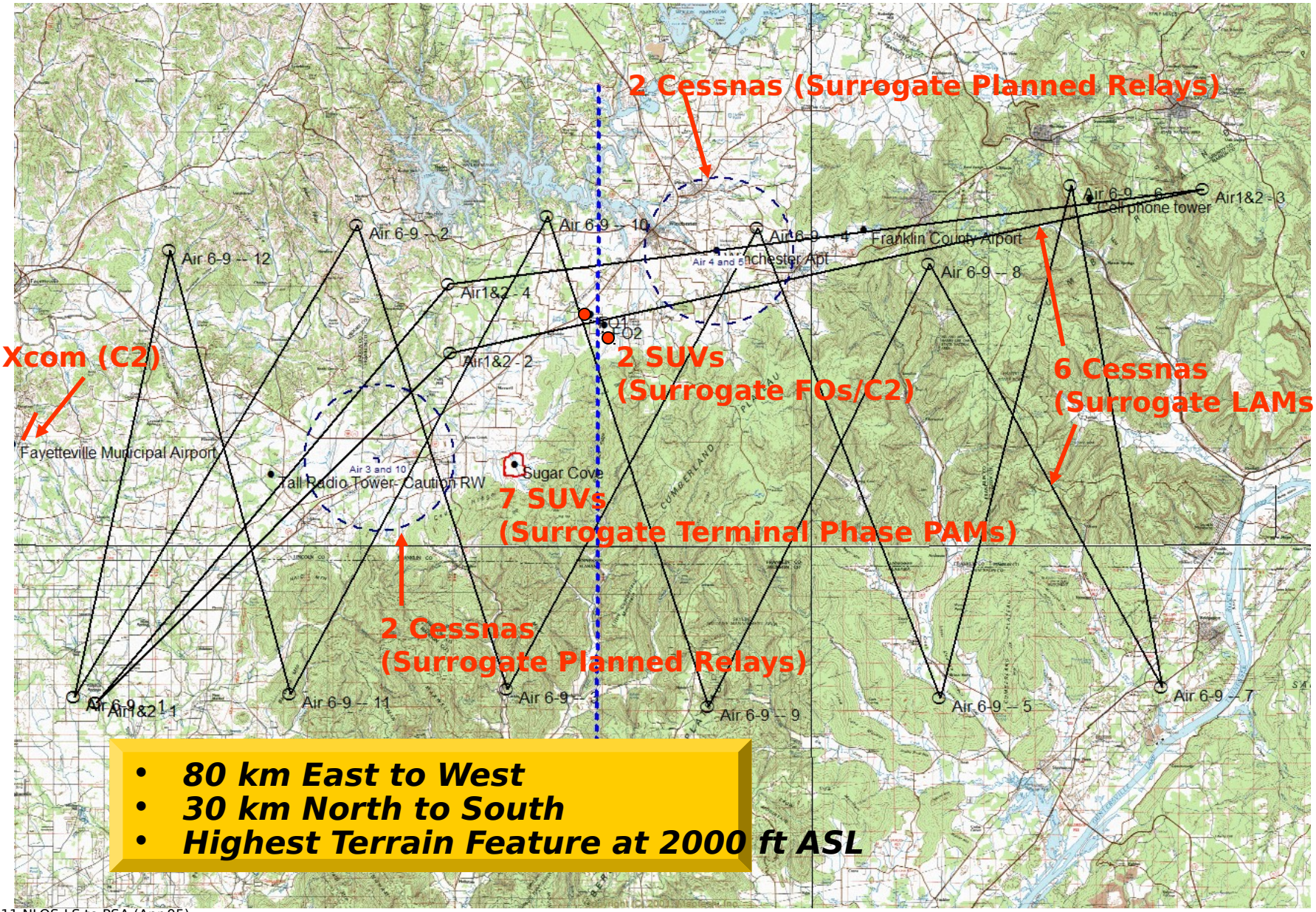
First, we had to establish a baseline for the NLOS-LS traffic load:

AMRDEC/ Ft. Sill Simulation Experiments

- **TRADOC-Approved:**
  - **FCS Scenarios**
  - **Force Structures**
  - **CONOPS**
- **ITT and Raytheon NLOS-LS Missile Subnets Explicitly Modeled**
- **NLOS-LS Mission Planners & Imagery Display Explicitly Played**
- **LAM & PAM Detailed Flight Models (Speed**

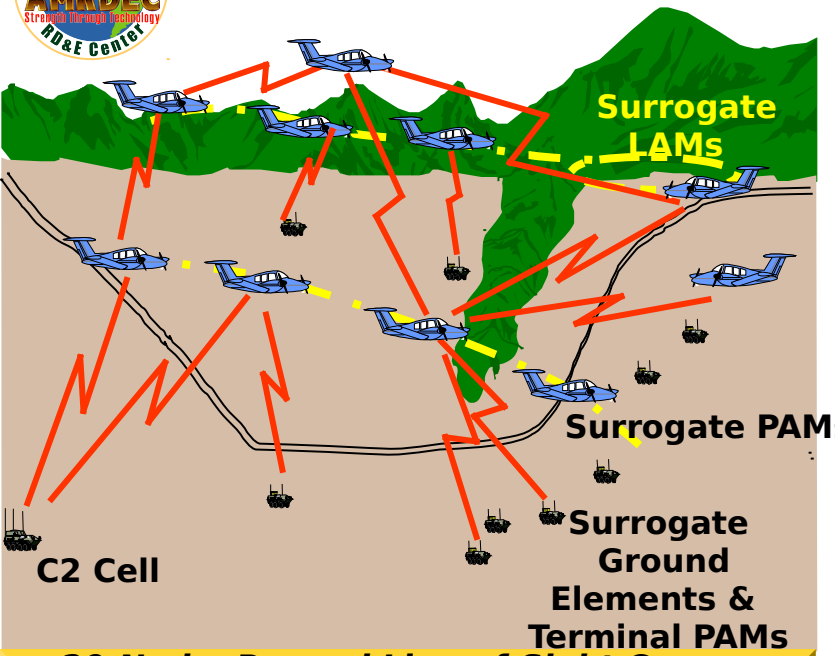


NLOS-LS Captive Carry Communications Test

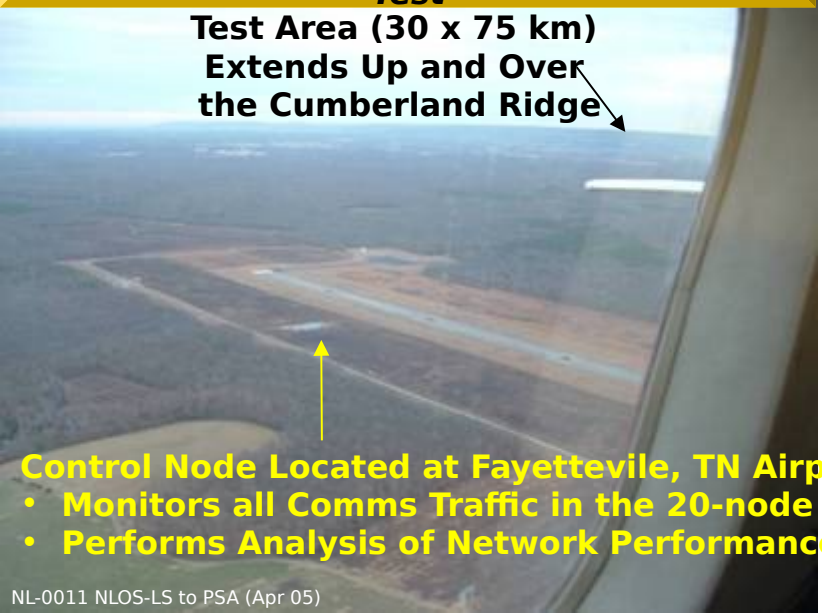


- *80 km East to West*
- *30 km North to South*
- *Highest Terrain Feature at 2000 ft ASL*

Networked Fires Using NLOS-LS STO (FY02-04)



20-Node, Beyond Line-of-Sight Comms Test

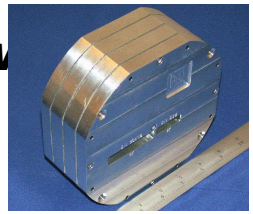

Test Area (30 x 75 km) Extends Up and Over the Cumberland Ridge
Control Node Located at Fayettevile, TN Airport
• Monitors all Comms Traffic in the 20-node Test
• Performs Analysis of Network Performance

Purpose:

Develop and Test Communications Networking for NLOS-LS Missiles

Products:

- ***Soldier Radio Waveform (SRW) Modified to Support NLOS-LS Missile Requirements***
- ***Two Form-Factored, Prototype Missile Radios and a Missile An***
- ***Ra ms Softw***



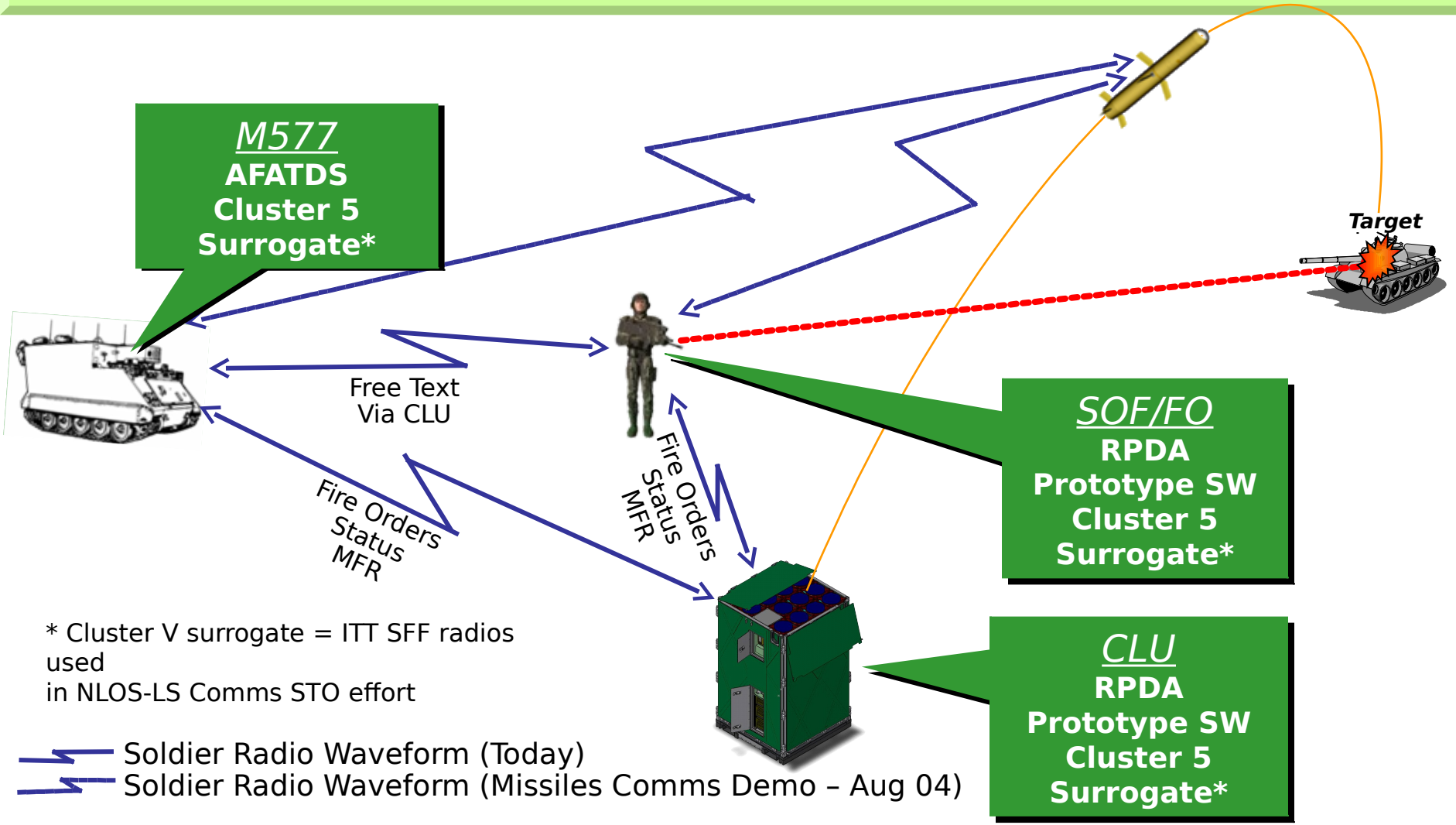
Results:

- ***NLOS-LS Bandwidth Requirements Established and Proven for UA Operation***
- ***Air-Ground Dynamic Network Tested and Proven***
- ***Imagery can be Transferred Over***

NLOS-LS Ground Comms Demonstration - 18 Nov 2004

FUTURE COMBAT SYSTEMS FCS One Team-The Army/Defense/Industry

Demonstration for PEO-TM with PM UA Networks, LSI and PEO C3T P

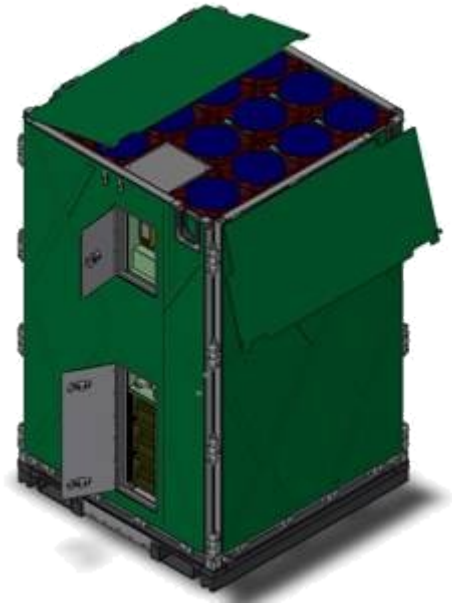


* Cluster V surrogate = ITT SFF radios used
in NLOS-LS Comms STO effort

Soldier Radio Waveform (Today)
Soldier Radio Waveform (Missiles Comms Demo – Aug 04)

NLOS-LS
Supportability

- **MBCT/UA's Logistics Support and O/S Costs Minimized**
  - Soldier and Depot Level Maintenance Only
  - Line Replaceable Units (LRUs)
  - Common FCS Rechargeable Battery
  - Standard NATO Slave Connection
  - Limited Tools Required to Replace LRUs
- **Fully Integrated Interactive Electronic Technical Manuals (IETM)**
  - Embedded RPDA on CLU
  - Enables Training and Maintenance Without Additional TMDE or Manuals
- **Predictive Logistics Increases Cdr's Flexibility**
  - Embedded Platform Soldier Readiness System (PSMRS) Software feeds the FCS Network's Logistics Decision Support System (LDSS)
  - Provide Predictive Prognostics, Diagnostics, and Planning at All Levels of Command



NLOS-LS S&T Roadmap

Capability Upgrades - Spiral Development

FUTURE COMBAT SYSTEMS
FCS
One Team-The Army/Defense/Industry

FY	04	05	06	07	08	09	10	11	12	13	14	15	16

FCS Schedule

MSB Update ◇ | PDR ◇ | IPD1 ◇ | CDR ◇ | IPD2 ◇ | Milestone C ◇ | IOC ◇ | FDTE ◇

SO 1 Assess | SO 2 Assess | SO 3 Assess | SO 4 Assess

SO 1 Prod | SO 2 Prod | SO 3 Prod | SO 4 Prod

SO 1 Fielding | SO 2 Fielding | SO 3/UA Fielding | SO 4/UA1 Fielding | SO 4/UA2 Fielding

NLOS-LS Schedule

Pre-production CLU Deliveries

PDR ◇ | CDR ◇ | LRIP ◇ | IOC ◇

Pre-SDD | NLOS-LS PAM/CLU SDD | NLOS-LS LRIP/Production

Threshold+ Capability

EPAM Seeker

Transition to PAM SDD

Transition Mature Technology

NLOS-LS Spiral SDD | NLOS-LS LRIP/Prod

PAM Enhanced Propulsion*

PAM Warhead Integration (Development-ARDEC)**

Tri-mode Seeker*

Future System Improvements: Capability Upgrades

- Increased ATR Processing
- Aiming Algorithms
- Extended Ranges/Loiter Time
- Urban Environment Operations
- Increased FOV for Seekers
- NLOS Communications
- Simulations
- Bandwidth Utilization
- Signature Reduction and IM
- Adverse Weather Performance
- Reduced TOF
- ADA Variant
- IMU Accuracy/Affordability
- Extended Power

* Proposed Joint Program with Navy

** Proposed Joint STO with ARDEC

PDR ◇ | CDR ◇

NLOS-LS LAM SDD | NLOS-LS Threshold+ Capability

Integ Flight Tests

ELAM Trades

ELAM Airframe Improved Agility

ELAM Seeker Cost Reduction

Adv. Turbo Fan Propulsion

S&T Efforts for Enhanced LAM Capabilities – Transition to LAM SDD

"Take-Aways" on NLOS-LS

FUTURE COMBAT SYSTEMS FCS
One Team-The Army/Defense/Industry

- *NLOS-LS is on Track for Spiral 1*
  - ***PAM: Component Level Risks Have Been Addressed***
  - ***CLU: Prototyping has Provided Great Insights into Power and Interoperability Activities***
- *LAM Efforts Underway in S&T to Reduce Cost and Enhance Performance*
- *Joint Efforts Continue and Will Expand*
  - ***Current Navy Funding on NLOS-LS Contract for Putting PAM on Littoral Combat Ships***
  - ***Special Operations Forces have High Interest***
- ***NLOS-LS Task Force Director Objectives:***
  - ***Provide PAM Lethality to Current Forces ASAP***
  - ***Get LAM Back on Track to Support Future Forces***

NLOS-LS Brings the Future to Today's Joint Forces